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Environmental Protection  
Agency

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[www.epa.gov/osw](http://www.epa.gov/osw)

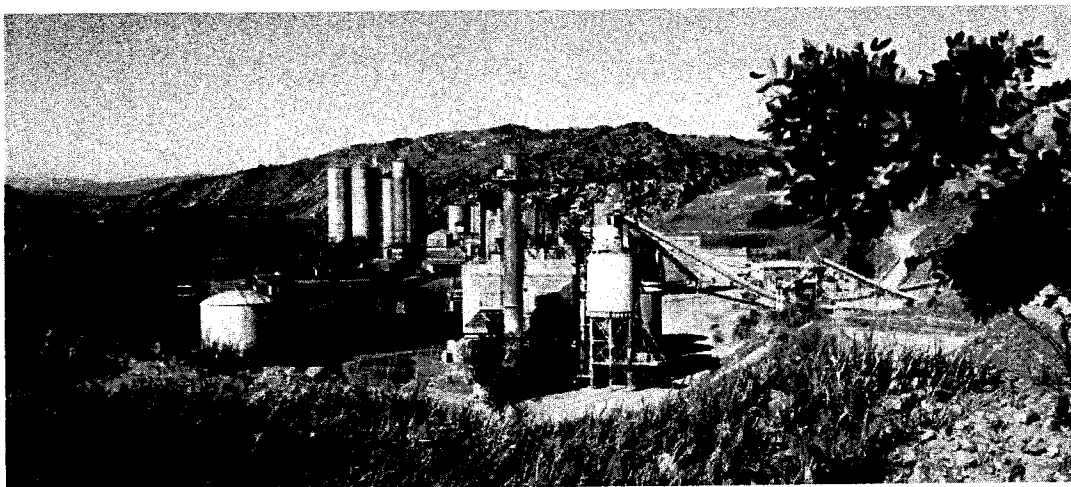
## Tire-Derived Fuel (TDF)

The Environmental Protection Agency (EPA) supports the highest and best practical use of scrap tires in accordance with the waste management hierarchy, in order of preference: reduce, reuse, recycle, waste-to-energy, and disposal in an appropriate facility. Disposal of scrap tires in tire piles is not an acceptable management practice because of the risks posed by tire fires, and because tire piles can provide habitats for disease vectors, such as mosquitoes.

In 2003, more than 290 million scrap tires were generated in the U.S. Nearly 100 million of these tires were recycled into new products and 130 million were reused as tire-derived fuel (TDF) in various industrial facilities. TDF is one of several viable alternatives to prevent newly generated scrap tires from inappropriate disposal in tire piles, and for reducing or eliminating existing tire stockpiles.

Based on over 15 years of experience with more than 80 individual facilities, EPA recognizes that the use of tire-derived fuels is a viable alternative to the use of fossil fuels. EPA testing shows that TDF has a higher BTU value than coal. The Agency supports the responsible use of tires in portland cement kilns and other industrial facilities, so long as the candidate facilities: (1) have a tire storage and handling plan; (2) have secured a permit for all applicable state and federal environmental programs; and (3) are in compliance with all the requirements of that permit.

More information on the use of TDF in kilns and boilers is available on EPA's scrap tire web site at: <http://www.epa.gov/epaoswer/osw/non-hw/muncpl/tires.htm>. The web site also contains links to other EPA, state, and industry information on the use of TDF.



## Holcim's Trident Plant: an enduring part of Montana's historical tradition

This year, Montanans continue to celebrate the bicentennial of the Lewis & Clark Expedition. Many landmarks of Lewis & Clark's epic journey stand today to remind us of how today's generation is linked to generations of the past.

The Headwaters Corridor represented a major segment of the Lewis & Clark journey. Clark's journal actually mentions the limestone formations at the headwaters of the Missouri River.

Approximately 100 years later, these formations provided a key raw material for the new Trident cement plant. The limestone deposits are still plentiful in the area, and the Holcim Trident Cement Plant continues to manufacture high-quality cement products that are used to build roads, bridges and home foundations in Montana and neighboring regions with a strong commitment to safety and environmental protection.

Even though our plant operations began nearly a century ago, our technologies, processes and improvements continuously evolve. We've continually upgraded the plant's technology to improve product quality, energy efficiency and health and safety.

- The Trident plant has grown with the community, currently devoting \$6.5 million of its \$19 million annual operating budget to employee wages and benefits, and, as Gallatin County's fifth largest taxpayer, generating \$550,000 in property and mining taxes for the county;
- The Trident plant is registered as an ISO 14001 facility, with an environmental management system and voluntary environmental audits to help ensure that we operate efficiently and in compliance with all applicable federal, state, local, and company regulations and standards;
- The plant produces 320,000 metric tons of cement per year, enough to create 1.5 million cubic yards of concrete; much of our product goes to construction projects in Montana, where the state's growing population will increase the demand for cement by 27% in the next 25 years.

At Holcim's Trident Plant, we honor the past and help build the future.

Holcim (US) Inc.  
4070 Trident Road  
Three Forks, Montana 59752  
Contact:  
Nicole Prokop: 406 285 3997  
Fax: 406 285 3100  
[www.holcim.us](http://www.holcim.us)

TIRE-DERIVED FUEL

continued



Under their program for the voluntary reporting of greenhouse gases, the United States Department of Energy (USDOE) has estimated that the combustion of TDF produces less carbon dioxide (CO<sub>2</sub>) per unit of energy than coal [USDOE 2004]. This means that when TDF replaces coal in a portland cement kiln—for example, when scrap tires are used to heat the precalciner vessel instead of coal—less CO<sub>2</sub> will be produced.

The use of TDF is common in other parts of the world. In Japan, there were 103 million scrap tires produced in 2003 with 23% of them being used as a fuel in the cement industry. For that year Japan recycled 44% of all scrap tires through heat utilization [JATMA 2004]. Of the approximately 2.7 million metric ton of scrap tires handled annually in Europe, 27% are directed to energy recovery systems including portland cement kilns [EARI 2004].

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**Concrete  
Thinking**  
for a sustainable world



Portland Cement Association

Portland Cement Association is a trade association representing cement companies in the United States and Canada. PCA's U.S. membership consists of 46 companies operating 102 plants in 36 states. PCA members account for more than 97 percent of cement-making capacity in the United States and 100 percent in Canada.

**Portland Cement Association**

5420 Old Orchard Road  
Skokie, Illinois 60077-1083  
847.966.6200 Fax 847.966.9781

[www.cement.org](http://www.cement.org)

1130 Connecticut Avenue, Suite 1250  
Washington, DC 20036-3925  
202.408.9494 Fax 202.408.0877



TABLE 2

### Summary of 15 Portland Cement Manufacturing Plants Interested in Future Utilization of Tire-Derived Fuels

Ash Grove Cement Co. Chanute, KS Louisville, NE Nephi, UT	Glens Falls-Lehigh Cement Co. Glens Falls, NY Holcim (US) Inc. Trident, MT	Roanoke Cement Co. Cloverdale, VA Texas Industries, Inc. Midlothian, TX
California Portland Cement Co. Mojave, CA	Lafarge North America, Inc. Alpena, MI Buffalo, IA Calera, AL Ravena, NY Sugar Creek, MO	
Dragon Products Company Thomaston, ME		
Essroc Cement Corp. Bessemer, PA		

Table 2 lists 15 additional facilities in fifteen states that have expressed interest in obtaining a permit or have received a permit but have not begun utilizing scrap tires as a fuel. The delay in utilizing TDF may be due to equipment limitations at the cement plant, regional TDF availability, state regulatory agency review, and local community discussions. Figure 2 shows the locations of all of the facilities currently utilizing or interested in TDF.

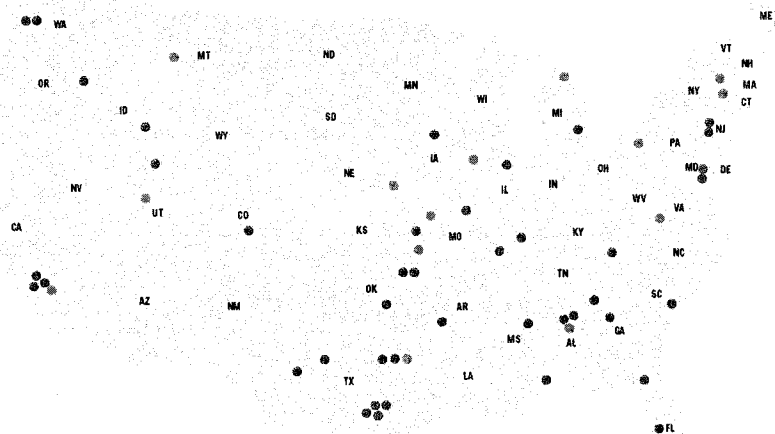
### Beneficial Effects

The environmental benefits of utilizing scrap tires as a supplemental fuel in the portland cement manufacturing process are multifold. When whole tires are combusted in cement kilns, the steel belting becomes a component of the clinker, replacing some or all of the iron required by the manufacturing process.

Portland cement manufacturers have known for some time that through staged combustion of fuel, such as scrap tires, nitrogen oxides ( $\text{NO}_x$ ) can be reduced from 0% to over 30% depending on the kiln type, age, fuel combustion location, and the plant's ability to optimize the manufacturing process. An USEPA-sponsored study on  $\text{NO}_x$  reductions reported that TDF added to the raw material feed end of some preheater or precalciner kilns can reduce  $\text{NO}_x$  emissions over 30%, and it also found that when mid-kiln injection of scrap tires was used, there was an average  $\text{NO}_x$  reduction of 33% and 40% for selected long dry and wet kilns, respectively [USEPA 2000]. The Mojave Desert Air Quality Management District in California has determined that TDF use is  $\text{NO}_x$  RACT ("Reasonably Available Control Technology") for portland cement kilns [CARB, 2002].

FIGURE 2

### U.S. Portland Cement Plants Currently Utilizing or Interested in Tire-Derived Fuel



- Portland cement plants currently permitted and utilizing tire-derived fuels (43)
- Portland cement plants interested in utilizing tire-derived fuels (15)

### MID-KILN INJECTION OF SCRAP TIRES

With every revolution of their kiln, the Ash Grove Cement Company plant in Midlothian, TX injects one or two scrap tires through a special port. This automated system allows the plant to utilize whole tires to replace up to 25% of the traditional fossil fuels required by the manufacturing process.



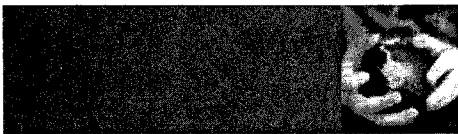
### TIRE HANDLING SYSTEM FOR PORTLAND CEMENT PLANT

At the Capital Aggregates cement plant in San Antonio, TX, scrap tires are received and stored in semi trailers. These trailers are hydraulically lifted to allow the tires to roll into a singulator which extracts one tire at a time and places it on the conveyor system. The automated conveyor transports the scrap tires to the injection point in the kiln system.



### FOR ADDITIONAL INFORMATION, CONTACT:

Garth Hawkins  
Portland Cement Association  
5420 Old Orchard Road  
Skokie, IL 60077 USA  
Voice: 847-972-9180  
Fax: 847-972-9181  
Email: ghawkins@cement.org



## TIRE-DERIVED FUEL

continued



Portland cement manufacturing is a four-step process:

Raw materials, including limestone and small amounts of sand and clay, come from a quarry usually located near the cement manufacturing plant. Limestone is typically about 80% of the raw mix and is the source of calcium. The remaining raw materials provide the silica and the necessary small amounts of alumina and iron.

The materials are carefully analyzed, precisely combined and blended, and then ground for further processing.

The ground materials are heated in an industrial furnace, called a kiln, which reaches gas temperatures of 1,870° C (3,400° F). The heat causes the materials to turn into a new substance called clinker. The kiln flame is fueled by powdered coal, powdered petroleum coke, natural gas, oil, and/or recycled materials burned for energy recovery.

Red-hot clinker is cooled and ground with a small amount of gypsum. The end-result is a fine gray-colored powder called portland cement.

At each stage, process data are continuously monitored to produce a high-quality product, improve energy efficiency, and minimize emissions.

### CEMENT OR CONCRETE?

The terms cement and concrete are often misused. Cement is an ingredient of concrete. It is the fine gray powder that, when mixed with water, sand, and gravel or crushed stone, forms the rock-like mass known as concrete. Cement acts as the binding agent or glue.

Like fossil fuels such as coal, oil, and natural gas, tires contain hydrocarbons. Pound for pound, tires have more fuel value than coal. Tens of millions of used tires are generated annually in the United States. By simply disposing of these tires, we miss an important recycling opportunity: the chance to recover their energy and conserve our resources of fossil fuels.

Cement making is an ideal process for recovering this energy. The intense heat of the kiln ensures complete destruction of the tires. There is no smoke or visible emissions from the tires. In fact, the use of tires as fuel can actually reduce certain emissions.

### An Alternative to Traditional Fossil Fuels

The Rubber Manufacturers Association (RMA) has estimated that almost 130 million scrap tires were used as fuel in portland cement plants in 2003 out of the 290 million tires produced that year [RMA 2004]. The United States Environmental Protection Agency (USEPA) states that tire-derived fuel (TDF) contains about the same amount of energy as oil and 25% more energy than coal [USEPA 2003]. This means that each ton of TDF used by a portland cement plant has the potential to replace 1.25 tons of coal, and the impacts of coal mining, processing, and transporting are avoided. In energy terms, the cement industry consumed 7.59 trillion BTUs of TDF in 2001 which is approximately 2.4% of all of the non-electrical energy required by the manufacturing process [PCA 2004].

### TDF Use Is Increasing

The number of cement plants utilizing scrap tires as a supplemental fuel has risen dramatically over the last 15 years. Figure 1 shows the increase in portland cement plants utilizing TDF [PCA 1991, 1996, and 2004]. As of 2004, state and local environmental agencies have approved the use of TDF at 43 plants in 22 states (Table 1).

FIGURE 1

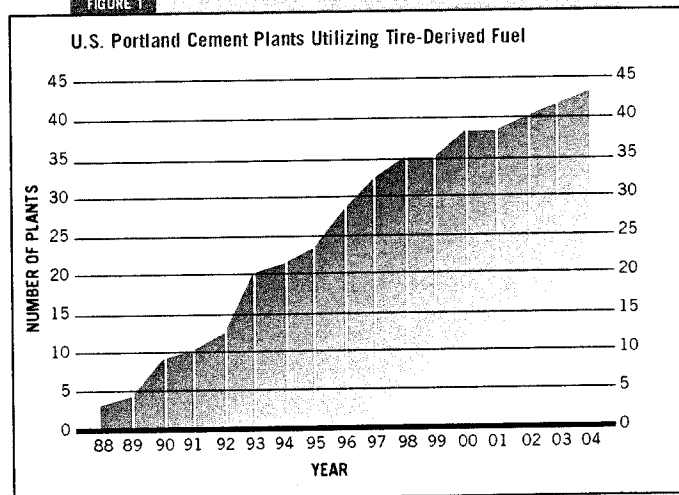


TABLE 1

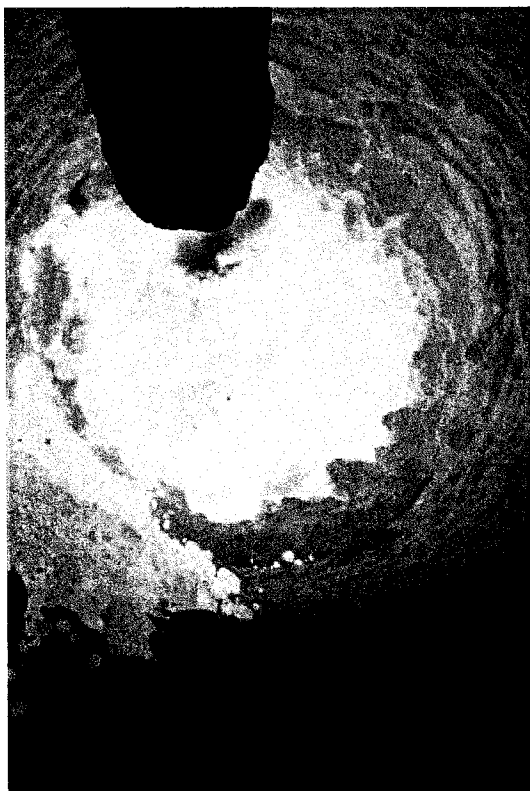
Summary of 43 Portland Cement Manufacturing Plants Currently Permitted and Utilizing Tire-Derived Fuels

<b>Ash Grove Cement Co.</b> Durkee, OR Foreman, AR Inkom, ID Seattle, WA Midlothian, TX	<b>CEMEX</b> Clinchfield, GA Knoxville, TN New Braunfels, TX Odessa, TX	<b>Lafarge North America Inc.</b> Atlanta, GA Grand Chain, IL Harleyville, SC Seattle, WA Tulsa, OK Whitehall, PA	<b>Rinker Materials Corporation</b> Brooksville, FL
<b>Buzzi Unicem USA</b> Cape Girardeau, MO Oglesby, IL Pryor, OK Sweetwater, TX	<b>Essroc Cement Corp.</b> Buckeytown, MD	<b>Lehigh Cement Company</b> Blandon, PA Leeds, AL Redding, CA	<b>St. Lawrence Cement Co.</b> Hagerstown, MD
<b>California Portland Cement Co.</b> Colton, CA	<b>Florida Rock Industries</b> Newberry, FL	<b>Mitsubishi Cement Corp.</b> Lucerne Valley, CA	<b>Texas Industries, Inc.</b> New Braunfels, TX Oro Grande, CA
<b>Capitol Aggregates, Inc.</b> San Antonio, TX	<b>Holcim (US) Inc.</b> Ada, OK Artesia, MS Clarksville, MO Dundee, MI Florence, CO Mason City, IA Midlothian, TX Morgan, UT Theodore, AL	<b>Monarch Cement Company</b> Humboldt, KS	<b>Texas-Lehigh Cement Co.</b> Buda, TX
		<b>National Cement Company</b> Ragland, AL	



# Why use tires as fuel for the cement making process?

## For the Energy and the Iron and our Commitment to Sustainability



View of the inside of a cement kiln, where some of the highest temperatures for any manufacturing process transform raw materials into cement clinker.

### How hot is hot?

**A cement kiln's flame reaches temperatures of 3400° F, or ...**

**Nearly seven times as hot as a home oven (500° F);**

**Nearly six times hotter than a campfire (600° F);**

**Almost twice as hot as lava (2000° F);**

**More than twice as hot as a forest fire (1500° F); and,**

**about one-third as hot as the surface of the sun (11000° F).**

The process of making cement requires extremely high temperatures to transform a precise mix of essential raw materials — such as limestone, sand, iron ore and clay — into a high-quality finished product.

The heart of the cement manufacturing process is the cement kiln — a long, enclosed, brick-lined steel cylinder in which the materials are heated to temperatures exceeding 2500°F. At these temperatures, many chemical and physical changes take place, breaking down the natural minerals to create stronger synthetic materials called clinker. The clinker is then ground in a ball mill with gypsum, where it is pulverized into a fine gray powder, the finished form of cement.

Flame temperatures exceeding 3400°F — among the highest for any manufacturing process — are required to make clinker. Fuels required to achieve these temperatures must have high heat values and must not contain elements that will be a detriment to product quality or kiln temperature profiles, or negatively impact emissions.

**Tire-derived fuel (TDF) will be an excellent supplement to coal, our primary fuel, for several reasons:**

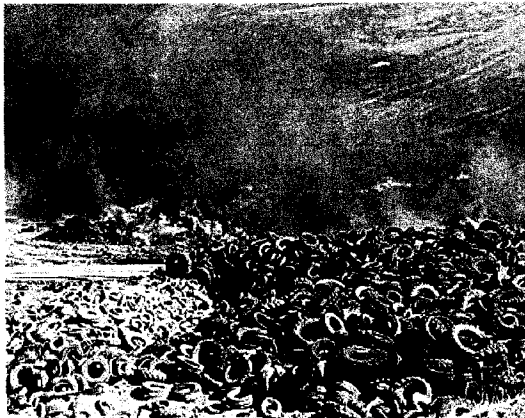
- TDF provides high heat value and burns cleaner than traditional fuels, resulting in a net reduction of total emissions.
- TDF preserves natural resources, saving more than 2 gallons of oil or 25 pounds of coal for each tire burned.
- TDF keeps tires out of landfills, and reduces stockpiling and illegal dumping, thereby eliminating potential breeding grounds for rodents and mosquitoes.
- TDF is consumed completely in cement kilns, where the high temperatures, internal turbulence and long residence time eliminate the possibility of black smoke, soot or odors.

According to the EPA, the facts are indisputable:

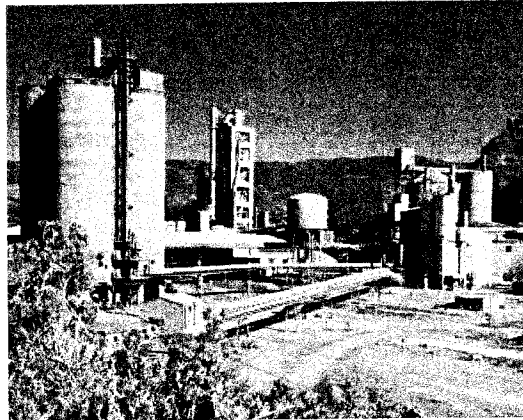
"The combination of long residence time and high temperatures makes cement kilns an ideal environment for TDF (tire-derived fuel). Emissions are not adversely affected compared to baseline fuels and often represent an improvement."

Holcim (US) Inc.  
4070 Tildent Road  
Three Forks, MT 59752

Contact:  
Nicole Prokop: 406 285 3997  
Fax: 406 285 3100  
[www.holcim.com/us](http://www.holcim.com/us)



Uncontrolled scrap tire pile fire, Stanislaus County, California, 1999.



Holcim's Utah plant has been using tires as a fuel for almost a decade — no ugly smoke, no fumes.

## Using Scrap Tires for Energy Recovery — Myths and Facts

**Myth:** Burning tires in cement kilns will create black smoke and odors.

**Fact:** Black smoke and odors result from the open and uncontrolled burning of stockpiled or illegally dumped tires. The scrap tires to be used as tire derived fuel (TDF) inside Trident's cement kiln will be consumed at temperatures exceeding 2100 degrees Fahrenheit. At those temperatures tires burn cleanly, replacing coal, a non-renewable resource.

**Myth:** The Trident plant will burn millions of scrap tires every year, importing many thousands of tires from other states.

**Fact:** The permit application included use of tires for up to 15% of the heat input to the kiln, which equates to almost 1.14 million tires in a year. However, Holcim anticipates using about 1,800 tires per day, or 657,000 tires per year. Montanans generate about 800,000 scrap tires every year. So we may not need to bring in tires from other states, but if we do, those tires will be consumed in our kiln — not landfilled for generations to come.

**Myth:** The use of scrap tires in cement kilns is a new, "untested" process.

**Fact:** Scrap tires are currently being used as fuel in 43 cement plants in 22 states all across the country. Many of those plants have been using TDF for more than a decade. Also, scrap tires are widely accepted as a fuel in other parts of the world, including several European countries.

**Myth:** The use of tires in the fuel mix at the Trident plant will increase emissions.

**Fact:** The use of TDF in cement kilns typically results in lower total emissions when compared to the use of coal exclusively. The EPA supports TDF use in cement kilns when permit conditions are met. Trident does and will continue to monitor its stack emissions through multiple continuously-operating monitors and site-specific emissions testing.

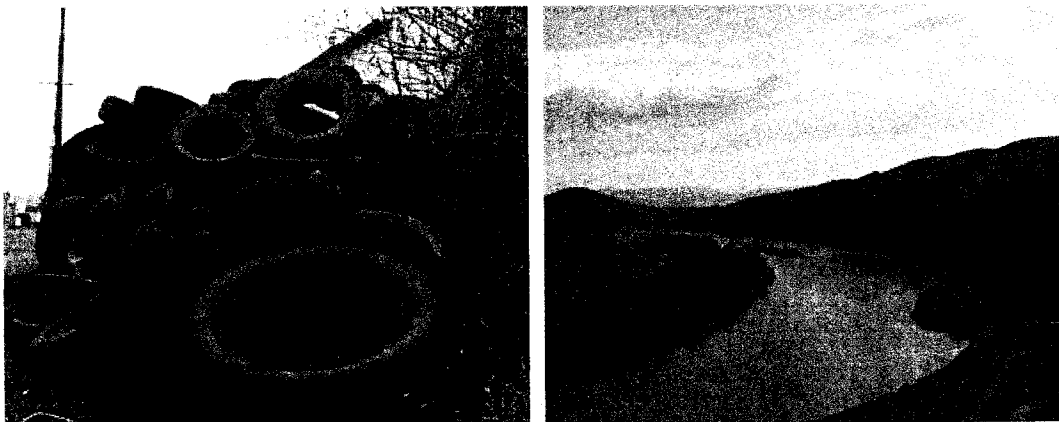
**Myth:** There are better alternatives for scrap tires than using them for energy recovery.

**Fact:** Unfortunately, development of economically viable re-uses for scrap tires is not keeping pace with the scrap tire generation rate. In the US, about 290 million scrap tires are generated annually. Only about 30% of those scrap tires are recycled to ground rubber markets (playground surfaces, etc.) and civil engineering applications. The remaining 70%, over 200 million tires, are likely to end up being wasted unless they are used in energy recovery. Holcim's proposal offers Montana a better option for tire management and resource recovery.

### Overall benefits of using scrap tires as a fuel supplement — The Facts:

- TDF is an excellent fuel source — pound for pound, tires have more heat value than coal.
- TDF reduces the number of stockpiled and illegally dumped tires, thereby reducing fire and health hazards.
- TDF helps conserve natural resources such as coal and natural gas.
- TDF can actually reduce total emissions from cement plants.
- The US Environmental Protection Agency recognizes TDF as a viable alternative to fossil fuels and supports its use in cement kilns when all permit conditions are met (<http://www.epa.gov/epaoswer/non-hw/muncpl/tires/tdf.htm>).

Holcim (US) Inc.  
4070 Trident Road  
Three Forks, MT 59752  
Contact:  
Nicole Prokop: 406 285 3997  
Heidi Bruner: 406 285 4977  
Fax: 406 285 3100  
[www.holcim.com/us](http://www.holcim.com/us)



# The choice is clear...

Each year, Montana residents generate about 800,000 scrap tires.

## Where do these scrap tires end up?

Unfortunately there currently are not many economically feasible recycling opportunities, so most of them are landfilled, stockpiled or illegally dumped.

## What's wrong with this picture?

Stockpiled and illegally dumped scrap tires mar the beauty of our environment. Even more important, they also present fire hazards and create health problems as breeding grounds for mosquitoes and vermin.

## What's wrong with landfilling scrap tires?

Even when sent to landfills, scrap tires cause problems. They take up space, they take virtually forever to decompose, and they tend to move within landfills, causing instability and damage to liners.

## What's the alternative?

Holcim has proposed to use scrap tires as fuel in their cement kiln. Using scrap tires in this manner is a proven technology that reduces the consumption of nonrenewable fossil fuels. Using just one tire saves two gallons of oil or 25 pounds of coal. Scrap tires used as fuel in the cement manufacturing process are completely consumed. The rubber in scrap tires provides fuel and the steel belting supplements the iron requirement in the cement recipe.

## What about emissions?

The U. S. EPA has concluded that, "The combination of long residence times and high temperatures makes cement kilns an ideal environment for TDF [tire-derived-fuel]. Emissions are not adversely affected compared to baseline fuels and often represent an improvement."

## The choice is clear...

This proven technology can help ensure that scrap tires don't end up trashing the beautiful landscape that Montanans are so justly proud of. Add in the benefits of conserved fossil fuels and the potential for reduced emissions and the picture gets even better for Montana.

Holcim (US) Inc.  
4070 Tidwell Road  
Three Forks, MT 59752  
Contact:  
Nicole Prokop: 406 285 3997  
Heidy Bruner: 406 285 4977  
Fax: 406 285 3100  
[www.holcim.com/us](http://www.holcim.com/us)





## It's all about appreciation...

Along with the residents of Gallatin County, we at Holcim's Trident cement plant appreciate the Montana Department of Environmental Quality's personal and professional responsibility to protect the health of our citizens and our environment. As part of this responsibility, we appreciate the Department's objective consideration of a proven technology for scrap tire management in Montana.

We are confident that the completed Environmental Impact Statement will confirm what 43 cement plants in 22 other states have demonstrated during almost two decades of practice: by recovering the energy of scrap tires through the cement making process, we can help safely eliminate an environmental hazard, conserve fossil fuel resources, and remain a vital economic force in the county.

We also appreciate that we have a responsibility to operate our plant in a way that protects the health and safety of our employees and neighbors and preserves the environment. Using scrap tires as a fuel supplement helps achieve these goals. In fact, studies have shown that the use of scrap tires as fuel can actually reduce certain emissions.

As part of our ongoing commitment to sustainable development, the Trident plant has built and implemented systematic Environmental and Quality Management Systems, which are certified under the ISO 9001 and ISO 14001 Standards, respectively. Maintaining this registration and undergoing the associated external audits twice annually further demonstrates that the Trident plant operates with both quality and environmental sustainability as integral components of its business practices.

We appreciate the opportunity we've had for nearly 100 years to play an important role in the economic life of our community. By manufacturing cement, we produce an essential component for our nation's vast infrastructure. We also employ nearly 100 people, pay more than \$20 million annually in benefits, wages, state and local taxes, while purchasing goods and services from our neighbors.

Finally, we appreciate the historical legacy and beauty of Montana's great outdoors, especially the headwaters area we call home. By ridding the landscape of unsightly piles of scrap tires, we allow that beauty to shine through as it was meant to.

Holcim (US) Inc.  
4070 Trident Road  
Three Forks, MT 59752  
Contact:  
Nicole Prokop: 406 285 3997  
Heidy Bruner: 406 285 4977  
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[www.holcim.com/us](http://www.holcim.com/us)